

CLAIMSWHAT IS CLAIMED IS:

- 1 1. A device for sorting biological material comprising:  
2 a microfabricated substrate having at least one main channel and at  
3 least two branch channels which meet at a junction,  
4 a detection region upstream and proximate to the junction comprising a  
5 detection apparatus for evaluating the biological material according to at least  
6 one characteristic as the material passes through the detection region,  
7 a discrimination region downstream from the detection region,  
8 a flow control system responsive to the detection apparatus and  
9 adapted to direct biological material through the discrimination region into a  
10 branch channel.
- 1 2. A device of claim 1, wherein at least one of the main and outlet  
2 channels communicates with a reservoir.
- 1 3. A device of claim 1, wherein the substrate is comprised of silicon.
- 1 4. A device of claim 1, wherein the substrate comprises a silicone  
2 elastomer.
- 1 5. A device of claim 1 wherein the biological material comprises cells.
- 1 6. A device of claim 4 wherein the silicone elastomer substrate is  
2 made from an impression of an etched silicon wafer.

101180-065260

1 7. A device of claim 1 wherein the flow control system is electro-  
2 osmotic

1 8. A device of claim 1 wherein the flow control system is  
2 electrophoretic.

1 9. A device of claim 1 wherein the flow control system is  
2 dielectrophoretic.

1 10. A device of claim 1 wherein the flow control system is pressure  
2 driven.

1 11. A device of claim 1 wherein the flow control system is  
2 microvalve.

1 12. A device of claim 1 wherein the flow control system is optical  
2 trapping.

1 13. A device of claim 1 wherein the flow control system is flow  
2 stoppage-based control.

1 14. A device according to claim 1 wherein the flow control is provided  
2 by a voltage gradient between the branch channels and the junction.

0992850-081301

1 15. A device according to claim 14 wherein the voltage gradient is  
2 generated by electrodes in the branch channels.

1 16. A device of claim 1 wherein the flow control is by a pressure  
2 gradient between one or more channels and the junction.

1 17. A device of claim 16 wherein pressure driven flow control is  
2 provided by capillary action at one or more channels of the substrate.

1 18. A device of claim 1 wherein the flow control comprises one or  
2 more valves.

1 19. A device of claim 17 wherein the flow control comprises one or  
2 more valves.

1 20. A device of claim 1 wherein the flow control is reversible.

1 21. A device of claim 1 wherein the characteristic is optically  
2 detectable.

1 22. A device of claim 1 wherein the characteristic is determined by a  
2 fluorescent reporter.

1 23. A device of claim 1 wherein the characteristic is determined by a  
2 chemiluminescent reporter.

09926590.081201

1 24. A device of claim 1 wherein the characteristic is determined by a  
2 radioactive reporter.

1 25. A device of claim 1 wherein the characteristic is determined by a  
2 spectroscopically detectable reporter.

1 26. A micro-fabricated sorter according to claim 1 wherein the  
2 predetermined characteristic is size.

1 27. A device of claim 1 wherein the detection apparatus comprises a  
2 light scattering apparatus.

1 28. A device of claim 1 wherein the detection apparatus comprises an  
2 apparatus for recognizing electromagnetic radiation.

1 29. A device of claim 28 wherein the detection apparatus further  
2 comprises a source of electromagnetic excitation.

1 30. A device of claim 29 wherein the excitation source is a light  
2 source and the recognizing apparatus is a charge coupled device.

1 31. A device of claim 1 wherein the detection apparatus comprises at  
2 least one of photomultiplier tubes and photodiodes.

1 32. A device of claim 1 wherein the detection apparatus is positioned  
2 to target biological materials within a predetermined detection region.

1 33. A device of claim 1, wherein the width and height of a channel of  
2 the device is at least about two times as large as the diameter of the largest  
3 material to be sorted.

1 34. A device of claim 1, wherein a channel is from about 20  $\mu\text{m}$  to 200  
2  $\mu\text{m}$  wide and about 20  $\mu\text{m}$  to 200  $\mu\text{m}$  deep.

1 35. A device of claim 1, wherein the biological material is a cell  
2 having a predetermined characteristic that is identified according to a reporter  
3 signal selected from a dye, fluorescent agent, chemiluminescent agent,  
4 chromophore, radio-isotope, and optically detectable protein.

1 36. A device of claim 35, wherein the control of flow is selected from  
2 electro-osmotic, electrophoretic, dielectrophoretic, pressure driven,  
3 microvalve, laser trapping and flow stoppage-based control.

1 37. A device of claims 36 wherein the control of flow is reversible.

1 38. A method for sorting a fluid mixture of cells comprising:  
2 providing the mixture of cells to a main channel of a microfabricated  
3 substrate, wherein the main channel is in fluid communication with at least  
4 two downstream branch channels which meet at a junction;  
5 producing a flow of fluid in the channels;  
6 interrogating each cell for a predetermined characteristic as it passes a  
7 detection region associated with the main channel;  
8 generating a signal indicating the results of the interrogation;  
9 directing the flow of each cell into a selected branch channel according

00928530.031301

10 to the signal.

1 39. A method of claim 38 wherein the width and height of each  
2 channel is at least about two times as large as the diameter of the largest cell in  
3 the mixture of cells.

1 40. A method of claim 38 wherein the characteristic is an optically  
2 detectable reporter in or on the cells.

1 41. A method of claim 38 wherein the cells are interrogated by at least  
2 one device selected from the group of microscopes, diodes, light stimulating  
3 devices, lasers, light scattering apparatuses, electromagnetic excitation  
4 sources, electromagnetic radiation detector apparatuses, photomultiplier tubes,  
5 and processors.

1 42. A method of claim 38 wherein the reporter is selected from a dye,  
2 fluorescent agent, chemiluminescent agent, chromophore, radio-isotope, and  
3 optically detectable protein.

1 43. A method of claim 38 wherein the flow is controlled by electro-  
2 osmosis, electrophoresis, dielectrophoresis, pressure gradient, microvalve,  
3 optical trapping and flow stoppage.

1 44. A method of claim 43 wherein the flow control is provided by a  
2 voltage gradient between the branch channels and the junction.

00922630 001701  
10E180 06582660

1 45. A method of claim 44 wherein the voltage gradient is generated by  
2 electrodes in the branch channels.

1 46. A method of claim 44 wherein the main channel comprises an  
2 electrode.

1 47. A method of claim 43 wherein the flow control is by a pressure  
2 gradient between one or more channels and the junction.

1 48. A method of claim 43 wherein the pressure gradient is provided by  
2 capillary action at one or more channels of the substrate.

1 49. A method of claim 38 wherein the flow control comprises one or  
2 more valves.

1 50. A device of claim 38 wherein the flow is reversible.

103180-06582660